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Regulating market risks in banks: A comparison of alternate regulatory regimes

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Abstract

Regulators have traditionally used simple models to measure the capital adequacy of banks. The growing internationalization and universalisation of banking operations has meant that the same is no longer possible as banks face increasing, and increasingly opaque, market risk. The significance of market risk has also been acknowledged in the New Capital Accord enunciated by the Basel Committee in 1999. The focus of the paper is on market risk-any market related factor that affects the value of a position in the financial instrument or a portfolio of instruments. As it stands at present, the three commonly used approaches to regulating market risks in banks include the building bloc approach, internal model approach and pre-commitment approach. The paper evaluates the pros and cons of the various approaches and concludes with a discussion of the applicability of these models in the Indian context.

I. Introduction

The Basle Accord of 1988 marks an important watershed in establishing capital standards among banks across the globe. Prior to 1992, under the Accord, uniform minimum capital standards were applied to all banks, regardless of any differences in the levels of their credit risk. The task of limiting banks' portfolio risks and ensuring capital adequacy, was left to regulatory monitoring and supervision, and to some degree, to market pressures [See Dewaripont and Tirole (1994) for a description of the 1988 regulations].

Under the risk-based capital (RBC) standards, banks were required to maintain capital equal to at least 8 per cent of *risk-adjusted* assets. Capital was divided into two components which were ranked according to the availability of funds to buffer losses. The tier-I or 'core' capital consisted primarily of paid-up capital and disclosed free reserves, while tier-2 or 'supplementary' included components such as undisclosed

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reserves, cumulative perpetual preference shares, revaluation reserves (at a discount of 55 per cent) and sub-ordinated debt. The risk-adjusted aspect of the capital standards involved allocating bank assets to different categories, each with a different risk weight, and to that extent, a movement away from a subjective judgement of capital requirements and towards a more objective rule-based approach. However, the growing disenchantment with the RBC standards has led regulators to search for feasible alternate possibilities to regulate market risk in banks. First, the risk-based standards have been criticized for arbitrarily assigning risk weights to different asset categories. For example, the standards treated home mortgages held by banks being half as risky as every commercial loan. Secondly, the risk-weighting scheme used in the RBC standards ignored variations in asset quality *within* categories. In other words, a short-term bank loan to a blue-chip corporate borrower is considered just as risky and requires just as much capital support as a long-term loan to a high-risk startup venture. Thirdly, as banks' internal risk assessments grew more sophisticated, it became clearer that the regulatory requirements of the original Accord were less and less able to adequately cover the underlying risks actually being taken. Most importantly, the 'one-size-fits-all' aspect of the CAR was the subject of intense debate and recent crises drilled home the point that baseline capital adequacy norms were not enough to hedge against failures. Recent work by Hellmann *et al.* (2000) also questioned the effectiveness of capital requirements as an effective instrument of prudential regulation in a liberalized economy. Finally, and most pertinently from the point of view of the present study, the RBC considered only credit risks in differentiating bank assets, to the exclusion of other kinds of risks, *viz.*, market risks such as interest rate and foreign exchange risks. The growing disenchantment with the RBC standards has led the regulators to search for alternative frameworks that incorporate market risks as well.

In the light of the aforesaid discussion, the rest of the paper proceeds as follows. Section II examines how the banking system in India have become vulnerable to market risk. Given the growing disenchantment with the RBC, efforts have been underway to develop alternate regulatory regimes that incorporate market risks as well. This is taken up in Section III. The merits and demerits of the various approaches are taken up in Section IV. Finally, Section V syncopates the concluding remarks.

II. The Indian Experience

With regard to the Indian experience, three sets of issues need to be delineated. The first is the issue of risk management for the banking system in India. The second is the approach towards such risk management. The final issue is the various kinds of market risks and their management². These are taken up in turn.

Pre-liberalisation, market risk (and interest rate risk, in particular) were not much of a concern since the high Statutory Liquidity Ratio (SLR) meant that banks' investment in Government paper ensured them a steady stream of (interest) income. Taken together with the ceiling on borrowing in the call money market and the regulated interest rate regime, this provided the balance sheets of banks with sufficient liquidity. At the same time, the prescription to keep foreign exchange positions square at the end of the day insulated banks from the dangers arising out of liquidity or margin mismatches on account of volatile rates. All in all, credit risk and to a lesser extent, operational risk, were the major risk factors facing banks in the regulated regime.

The era of administered regime having given way to one of deregulation and integration has meant that the banking sector has become increasingly susceptible to the vicissitudes of the global operating environment. The dichotomy in the structure of deposit liabilities and loan portfolios in which the liabilities are fixed *vis-à-vis* the floating rate character of the loan portfolio has exposed their balance sheet to interest rate risks. Secondly, with growing integration of forex markets with Rupee ones, and with banks being allowed to create liabilities and assets in multi-currencies, foreign exchange risks have also come to the fore. Thirdly, with the freedom given to banks to invest in bonds, shares and debentures of corporates, price risk has also become an area of prime concern³.

The money and foreign exchange markets have become intrinsically linked to each other, especially in view of commercial banks' dominant presence in both markets. The linkage

² The BCBS (1996) defines market risk as "the risk of losses in on and off-balance sheet positions arising from movements in market prices".

³ The Standing Technical Committee of the Reserve Bank and the Securities and Exchange Board of India (SEBI), in its Report, submitted to the Reserve Bank in August 2000, has sought to develop an approach to optimize the risk-return trade-off of banks from their investments in the capital market. Accordingly, banks' total exposure to capital market by way of investments in shares, convertible debentures and units of mutual funds (other than debt funds) should not exceed 5 per cent of the banks' total outstanding credit (as at year-end) of the previous year. The decision on investment in shares, debentures etc., would have to be made by the Board/ALCO of each bank, keeping in view the permitted tolerance levels of mismatch.

between the call money market and the foreign exchange market, which existed in the past as banks were permitted to maintain nostro account surpluses or overdrafts to some extent, has strengthened in recent times, particularly after the permission to borrow or lend up to 15 per cent of tier-I capital overseas. The linkage between call market and the forex market has been found to be more pronounced during episodes of volatile foreign exchange market conditions as evidenced during the years 1995-96 and subsequently in 1997-98 during the time of the Asian contagion (Table 1). This fact is clearly discernible in the second half of the nineties (Chart 1).

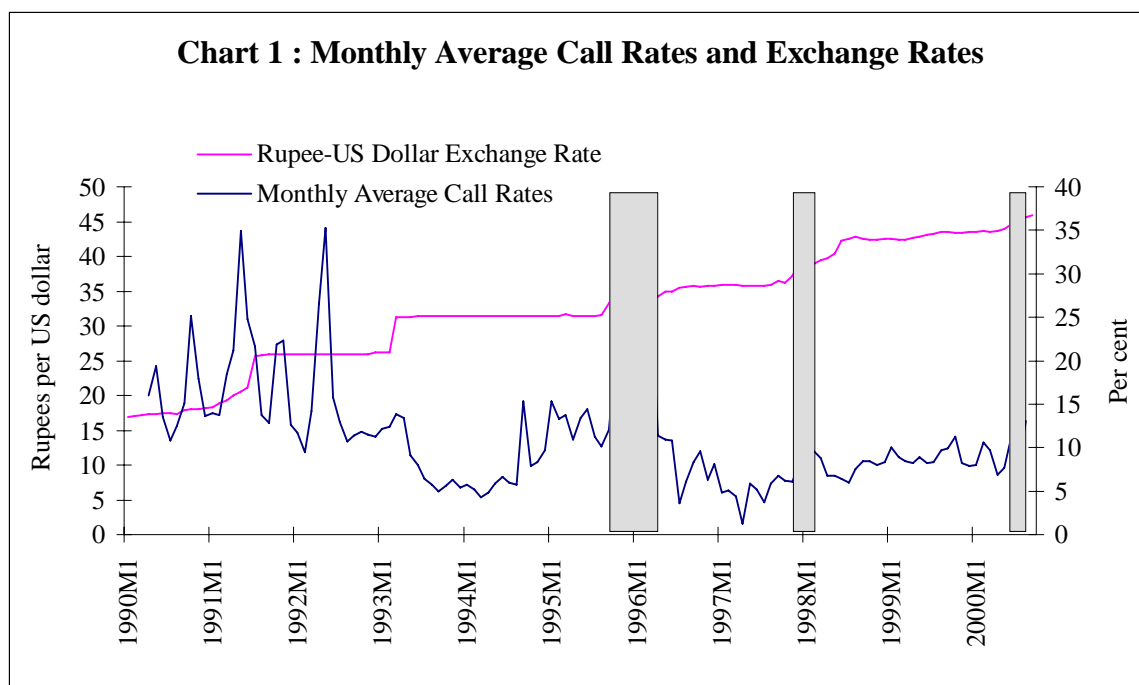


Table 1: Coefficient of Variation in the Money and Foreign Exchange Markets

Year	Call Rates	Exchange Rates
1994-95	42.1	0.3
1995-96	44.6	5.8
1996-97	37.3	1.4
1997-98	85.7	4.3
1998-99	15.0	2.3
1999-2000	12.3	0.7

In view of the growing incidence of market risks, which are capable of developing themselves into systematic risks, there has been growing concern among regulators to devise ways of quantifying such risks. The growing severity and bouts of financial crises

has meant a refocusing of strategy among central banks towards safeguarding financial stability, with an overt emphasis on banking sector stability. The collapse of the Barings Bank that had RBC standards more than 8 per cent at the end of 1993 also underscored the importance of market risk. Not surprisingly, this has led the Basel Committee on Banking Supervision (BCBS) to develop new sets of capital requirement to ensure banks have adequate capital to address market risk.

The new Accord allows a number of different options for calculating minimum capital requirements, and it seeks to provide incentives for banks themselves to continuously improve their internal risk management capabilities. Common to all these options is a greater differentiation between loans of different qualities. While the minimum *regulatory* risk-weighted capital ratio, at 8 per cent, has been left unaltered, it has been proposed that the risk weights used to compute risk-weighted assets and the comprehensiveness of the risks included be sufficiently broadened. Accordingly, in the new proposal, the denominator is the sum of credit risk, operational risk and importantly, market risk (as opposed to only credit risk in the denominator, earlier).

Mention may be made in this context that the Committee on Banking Sector Reforms (1998) had addressed the issue of risk and its management in its Report. In the words of the Committee, 'banks should be encouraged to adopt statistical risk management techniques like Value-at-Risk in respect of balance sheet items which are susceptible to market price fluctuations, forex rate volatility and interest rate changes" (pp.iv). Subsequently, the Reserve Bank had issued Risk Management Guidelines for the banks in India in October 1999. The guidelines broadly cover management of credit, market and operational risks. In conjunction with the guidelines on Asset- Liability Management (ALM) system, the present set of guidelines are purported to serve as a benchmark to the banks, which are in the process of establishing an integrated risk management system.

As regards positioning appropriate risk management strategies, several points need to be considered. First, in view of the worldwide trend towards centralising risk management with integrated treasury management to internalise the information synergies on various facets of risks, the primary responsibility of understanding the risks run by the bank and their pro-active handling needs to be vested with the Board of Directors. Secondly, at the organisational level, the Risk Management Committee needs to be entrusted with the task of identifying, measuring and monitoring the risk profile of the bank. In order to

safeguard against unforeseen contingencies, the Committee would need to design stress scenarios to measure the impact of unusual market conditions and monitor the variance of the portfolio within tolerable limits. However, in view of the wide heterogeneity among balance sheet items of banks in India, risk management at individual banks would need to dovetail themselves towards the bank's own requirement, dictated by the size and complexity of business and market perception and the existing level of capital. As discussed earlier, the various kinds of market risks that have assumed importance in the deregulated scenario are liquidity risk, interest rate risk, exchange rate risk and commodity price risk. Most commercial banks make a clear distinction between their trading activity and their balance sheet exposure. The Mid-term Review of Monetary and Credit Policy for the year 2000-2001 has announced detailed guidelines for categorisation and valuation of banks' investment portfolio (comprising SLR and non-SLR securities). These guidelines require banks to classify the entire investment portfolio into three categories, viz., 'Held to Maturity', 'Available for Sale' and 'Held for Trading'. Out of the three, the 'Held to Maturity' category is limited to a maximum of 25 per cent of total investments and need not be marked to market. On the other hand, banks have been given the freedom to decide the extent of holdings under 'Held to Maturity' and 'Available for Sale' categories. The individual scrips under 'Available for Sale' will need to be marked to market at the year-end or more frequent intervals, whereas the individual scrips 'Held for Trading' will have to be revalued at monthly or at more frequent intervals⁴. This is expected to lower both the portion of banks' portfolios subject to market risk and also act as a risk management device. As regards trading book, Value-at-Risk (VaR) is presently considered to be the standard approach. The VaR method is employed to assess the potential loss that could crystallise on trading position or portfolio due to variations in market interest rate and prices. For balance sheet exposure to interest rate risk, 'gap reporting system' is quite popular, as the asymmetry of repricing of assets and liabilities results in a gap (Box 1). This is often supplemented with the 'duration gap analysis' as well as balance sheet simulation models to investigate the effect of interest rate variation on reported earnings over a medium-time horizon. The

⁴ The details are contained in the *Mid-term Review of the Monetary and Credit Policy* for the year 2000-2001.

simulation reports the resultant deviations in earnings associated with the different rate scenarios considered, commonly measured in terms of Earnings at Risk (EaR)⁵.

Box 1 :. Gap Reporting System

Banks generally use two models to compute the interest sensitivity of their asset and liability portfolios. The first one measures the direction and extent of asset-liability mismatch through a funding or maturity gap. It is computed for specific time periods and over a fixed time horizon. The measure includes all fixed rate assets and liabilities that mature in those periods and over the horizon and all the variable rate asset and liabilities that have interest rates reset dates during those periods and the horizon. In other words, the measure calculates a sequence of periodic maturity gaps. Assets and liabilities are grouped in this method into time buckets according to the maturity or the time until the first possible resetting of the interest rates. For each time bucket, the gap (G) equals the difference between the interest rate sensitive assets (RSAs) and the interest rate sensitive liabilities (RSLs), so that $G = RSA - RSL$. A positive or asset sensitive gap means that an increase in market interest rates could cause an increase in NII. Conversely, a negative or liability sensitive gap implies that the banks' NII could decline as a result of increase in market interest rates.

However, the maturity gap analysis suffers from several drawbacks. First, it assumes that banks can flexibly adjust their assets and liabilities to obtain the desired gap. This assumption might not hold good in practice. For instance, priority sector considerations, the variety of credit delivery systems along with the legal provisions in loan documentation might not permit banks the requisite flexibility for desired gap positioning. Second, the technique focuses only on the current interest rate sensitivity of the assets and liabilities and ignores the effect of interest rate movements on the values of bank's assets and liabilities. This view of interest rate risk is said to be myopic and incomplete because yield curve movements that occur over the credit cycle can significantly affect the market value of bank assets and liabilities.

As a consequence of these shortcomings of the maturity gap analysis, the alternate method which has gained currency is the duration gap approach. Matching the duration

⁵ Earnings at Risk (EaR) refer to a percentage change in net interest income in response to a

of assets and liabilities, instead of matching the maturity or repricing dates is the most effective way to protect the economic values of banks from exposures to IRR. Duration gap focuses on managing economic value of banks by recognising changes in the market value of assets, liabilities and off-balance sheet (OBS) items. When weighted assets and liabilities and OBS duration are matched, market interest rate movements would have almost same impact on assets, liabilities and OBS, thereby protecting the bank's total equity or net worth. Duration is a measure of the percentage change in the economic value of a position that will occur, given a small change in the level of interest rates.

Scientifically, banks can estimate the economic value of changes to market interest rates by calculating the duration of each asset, liability and OBS position and weigh each of them to arrive at the weighted duration of assets, liabilities and OBS. Once the weighted duration is estimated, the duration gap can be calculated. The net duration is then the difference between duration of assets (DA) and duration of liabilities (DL). If the net duration is positive, a decrease in market interest rates will decrease the market value of equity (MVE) of the bank. In the reverse case, the MVE increases when the interest rate increases, but decreases when the rate declines. Thus, the duration gap shows the impact of the movements in market interest rates on the MVE through influencing the market value of assets, liabilities and OBS.

Balance sheet Projection For the Banking Portfolio

Banking Portfolio	Value at Date 1
Interest Rate Insensitive Assets (a)	19
Interest Rate Sensitive Assets (b)	17
Total Assets (c=a+b)	36
Interest Rate Insensitive Liabilities (d)	15
Interest Rate Sensitive Liabilities (e)	9
Total Liabilities (f=d+e)	24
Projected Gaps at date 1	
Liquidity Gap (c-f)	+12
Interest Rate Gap (b-e) ¹	+8
Total Balance Sheet	-4
Interest Rate Gap after funding (b-e)-(c-f) ²	

1. The interest rate gap is calculated as interest sensitive assets minus interest sensitive liabilities, or as 'variable rate' interest rate gap.
2. Funding is assumed to be floating rate before any hedging decision is made.

percentage point increase in interest rates.

As regards foreign exchange trading, limits are key elements of risk management. Banks with active trading positions have tended to adopt the VaR approach to measure the risk associated with exposure. For banks without VaR, some 'stress testing' is conducted to evaluate the potential loss associated with changes in the exchange rate.

The final point is the measurement of liquidity risk. There are several traditional ratios for liquidity risk measurement, *viz.*, loans to total assets, loans to core deposits, and loan losses to net loans, in addition to prudential limits on various liquidity measures like inter-bank borrowings, core deposits vis-à-vis core assets, to mention a few.

The Report of the Advisory Group on Banking Supervision (Chairman: Shri M.S.Verma), realizing the growing import of risk management, has recommended a wider set of disclosures relating to management of risks, including, among others, details about risk mitigating tools, impact of interest rate risk on bank's net interest margin, significant concentrations of foreign exposure by currency, disclosures on liquidity risk exposure as well as information about legal risks and operational risks.

The Reserve Bank, on its part, has initiated various steps in moving towards prescribing capital for market risk. As an initial step, a risk weight of 2.5 per cent has been prescribed for investments in Government and other approved securities, besides a risk weight of 100 per cent on the open position limits in forex and gold. A risk weight of 0.25 per cent on standard assets has also been prescribed.

III. Alternative approaches towards regulating market risks

In view of these developments, there has therefore been a search for alternative approaches to complement the extant capital adequacy framework. Three alternative approaches towards handling market risks have been discussed in the literature.

The first of the approach to the market risk capital standards is the Building Blocs Approach (BBA). The BBA consists of a single model to be applied to all banks. This approach is characterized by a 'building bloc' framework, a framework it shares with the 1988 Basle Accord credit risk capital standards. Two regulatory frameworks, those of the Capital Adequacy Directive (CAD) of the European Union and of the Basle Standardised Measures (BSM), incorporate this approach. Under this approach, capital charges are determined for each of the four major market risk categories (interest rate, exchange rate, equity and commodities) and are then aggregated. Different procedures are used for each

category to determine the category's respective capital charge. It is a set of rules that assigns risk charges to specific instruments and crudely accounts for selected portfolio effects on banks' risk exposures. Interest rate and exchange rate risks dominate the market risks for most banks trading departments. Under the building bloc approach, debt securities incur a specific and a market risk capital charge. The specific risk-charge is intended to cover changes in the market value of securities owing to changes in credit quality. It is a weighted average of gross debt security positions where the weights vary between zero and eight, according to the quality measures of the security (issuer, maturity, rating). These specific risk capital charges for interest rate products would substitute for the credit risk capital requirement these positions currently require under the Basle Capital Accord. The market risk charge covers changes in the value of the debt positions that owe to changes in the general level of (risk free) interest rates. Equity positions are subject to both a specific risk and a market risk capital charge. Equity capital charges are determined on a notional market basis and are then aggregated across markets at current exchange rates with no offsets permitted for hedging or diversification among markets. Finally, commodity capital charges are essentially 15 per cent of the net position in each commodity (Kupiec and O'Brien, 1997). Some additional capital charges are also assessed for basis risk and interest rate risk (Box 2).

Box 2 : Basis Risk

Market interest rates of various instruments seldom change by the same degree during a given period of time. The risk that the interest rate of different assets, liabilities and off-balance items may change in different magnitude is termed as basis risk. The degree of basis risk is fairly high in respect of banks that create composite assets out of composite liabilities. The Loan book in India is funded out of a composite liability portfolio and is exposed to a considerable degree of basis risk. The basis risk is quite visible in volatile interest rate scenarios. When the variation in market interest rate causes the net interest income (NII) to expand, the banks have experienced favourable basis shifts and if the interest rate movement causes the NII to contract, the basis risk has moved against the banks.

Derivative contracts in foreign exchange, interest rate and equities, are treated as if they were outright positions in the underlying securities, thereby allowing the relevant

general and specific risk requirements to apply. Firm commitment contracts (futures, options, swaps) are expressed as long and short positions in the underlying instruments.⁶ Options position risk may be included in capital measure under either the 'delta plus' method (the value of the underlying instrument is weighted by the options' deltas) or the cave out method (risk is determined over a specific range of underlying security values and return volatilities). The resulting capital charge is added to these for other components of the portfolio. The division into specific and general risks for debt and equity risk categories, for calculation of separate capital requirements for each risk category, and their simple addition, is what characterizes the BBA.

The second approach is the Internal Models Approach (IMA), whereby capital charges would be based on market risk estimates from banks' internal risk measurement models. The bank would use its proprietary risk measurement model to estimate its trading risk exposure which, when multiplied by a certain scaling factor as a measure of regulator's conservatism, would become the basis for the regulatory capital charge for market risk. Regulators would also impose a number of standardizing restrictions on banks' internal models, in order to ensure rough comparability across banks that use this approach. The IMA approach has been adopted recently by the Basle Committee as an alternative measure to the BSM.

The third and latest proposal is the Pre-commitment Approach (PA), based on work done by Kupiec and O'Brien (1997). Under this approach, each bank pre-commits to a maximum loss exposure over a designated horizon. The maximum loss commitment becomes the bank's market risk capital charge. If the bank incurs trading losses in excess of its capital commitment, it is subject to penalties, which may include fines, a capital surcharge in future periods, or other regulatory disciplinary measures.

Another issue is the rapid growth of derivative instruments, which has also posed new challenges to measurement of market risks. A recent report by the International Swaps and Derivatives Association (ISDA) shows that the transaction volume of over-the-counter derivatives (in notional amounts outstanding) has increased rapidly since the beginning of the 1990s and stood at US \$ 29.5 trillion in 1997 (Okina *et al.*, 1999). Whereas

⁶ For example, a futures contract to receive USD 1 million in 5 year Treasury notes in 1 month is treated as the sum of, (a) a long position in the 5 year (plus one month) note valued at its current

exchange-traded derivatives are extensively regulated by Government agencies, it is the unregulated nature of OTC derivatives trading, as well as its fast growth, that has been the cause for concern.⁷ Though it is widely agreed that the risks for end users or dealers involved in derivative activities is not new, derivatives business has two special attributes which distinguish it from more conventional financial activity: increased complexity and rapid risk transformation. The concerns here are that firstly, trading desk activities may lead to rapid changes in bank capital because of the potential volatility of the trading portfolio's value; and secondly, the failure of large banks involved in derivatives may have systematic implications.

Pertinent from the point of view of the Indian scenario are the Internal Models Approach and to a lesser extent, the Pre-commitment Approach, which are taken up for discussion. What follows is a brief description of the two approaches followed by an examination of the likelihood of the use of these models in the Indian context (Appendix A).

Internal models approach

In the past, banks have usually measured the risks in individual parts of their trading books separately. Nowadays however, they are increasingly moving towards a whole trading book approach, using a Value-at-Risk (VaR) model, which is a statistical approach to the evaluation of market risks. The aim of the VaR model is to calculate consistently the loss, with a specified probability, over a specified holding period of time, which a bank might experience on its portfolio from an adverse market movement. For example, with a confidence interval of 97.5 per cent, corresponding to about two standard deviations from the mean, any change in portfolio value over one day resulting from an adverse market movement will not exceed a specified amount, given the relationships between assets holding over the observation period. VaR should therefore encompass changes in all major market risk components (Box 3).

market price, which is slotted in the 4-5 maturity band and, (b) a short position in USD 1 million Treasury bills, slotted in the 1-3 month band.

⁷ The standard way to judge the size of OTC derivatives is by reference to the notional amount outstanding of particular types of derivatives. The notional amount is the face value of the principal of the underlying contract on which a derivative instrument is based. This is however, a misleading indicator of the size of derivative transactions because most cash flows arising from such transactions are small compared with notional principal. The latter is useful, though, as a

Box 3: Value at Risk: Numerical Examples

VaR typically answers the question: how much can one lose with x per cent probability over a given time horizon.

Example 1: Suppose a US-based Corporation holds DEM 140 million FX position. The idea is to estimate the VaR over a 1-day horizon, given that there is a 5 per cent chance that the realized loss will be greater than the VaR projected.⁸

Step 1- Exposure to market risk (i.e., 'mark to market'). As a US Corporation, the exposure is equal to the market value of the position in the base currency. If the foreign exchange rate is 1.40 DEM/USD⁹, the market value of the position is USD 100 million.

Step 2 - Moving from exposure to Risk: This requires an estimate of how much the exchange rate can potentially move. The standard deviation of the return of the DEM/USD exchange rate, measured historically can provide an indication of the size of rate movements. In this example, the calculated the DEM/USD daily standard deviation worked out to be 0.565 per cent. Under the *Risk Metrics* assumption that standardised returns on DEM/USD are normally distributed given the value of the standard deviation (i.e., 1.65), or 0.932 per cent, 95 per cent of the time. *Riskmetrics* provide users with the VaR statistics 1.65.

In Rupee, the VaR of the position¹⁰ is equal to the market value of the position times the estimated volatility or:

FX risk: USD100 million*0.932 %=USD 9,32,000

In other words, 95 per cent of the time, one will lose more than USD 9,32,000 over the next 24 hours.

Example 2: Suppose a bank has deployed Rs.200 crore in the call market. Historical data reveals that the average return on overnight lending in call market is 10 per cent while the standard deviation is 2.70 per cent.

crude measure of the relative importance of one type of derivative compared with another, or as a measure of the growth in one activity for one instrument.

⁸ The choice of the 5 per cent probability is discretionary and differs across institutions using the VaR framework.

⁹ The choice of the USD-DEM exchange rate is purely arbitrary in order to aid calculations.

¹⁰ This is a simplifying assumption.

Given the average return of 10 per cent and the standard deviation of 2.70 per cent, the fortnightly standard deviation is $2.70/\sqrt{24}=0.55$ per cent.

Assuming the returns are normally distributed¹¹, therefore, the rates of returns in call lending can be calculated as

Rates of Return in Call Lending	Confidence level (per cent)
$10+1*0.55=10.55$ $10-1*0.55=9.45$	68
$10+2*0.55=11.10$ $10-2*0.55=8.90$	95.5
$10+3*0.55=11.65$ $10-3*0.55=8.35$	99.7

Suppose that the bank received an offer from another bank to borrow Rs.200 crore at 8 per cent and the bank wants to know whether it should accept the proposal. Looking at the above figures, the bank can state that the lowest call rate during the fortnight is likely to be 8.35 per cent with 99.7 per cent confidence and hence, it is not advisable to accept the offer. If a decision is already taken to lend on above terms, the consequences can be stated as under:

Minimum Loss: $200*(8.35-8.00)*14/365=\text{Rs.}0.03$ crore

Maximum Loss: $200*(11.65-8.00)*14/365=\text{Rs.}0.28$ crore

The consequential loss of the above decision is likely to be between 0.03 crore and Rs.0.28 crore with 99.7 per cent confidence.

The VaR model retains the basic CAR philosophy of a 'hard link' between risk exposure and capital requirements, set exogenously by the regulator. However, there is an important difference. In the traditional CAR approach, the risk-weights are set by the regulator, whereas, in the VaR approach, the risk weights are based on the banks internal model. This amendment is addressed to overcome two weaknesses of the CAR approach- one, that it ignores diversification benefits accruing from holding assets of varying risk in the same portfolio and two, that it fails to efficiently exploit internal information specific to the bank. However, the VaR model comes with its own price tag. The regulator has to

¹¹ If the returns are normal distributed, then the chances of the value being between within one standard deviation (SD), 2 SD and 3 SD of the mean, are respectively, 68 per cent, 95.5 per cent and 99.7 per cent, respectively.

ensure that the bank's internal model does not misrepresent its risk exposure and hence, a checking mechanism has to be in place (Nachane *et al.*, 2000).

Although the internal models approach represents an important advance over standardised risk measure, it still has important disadvantages that might impair its efficiency and effectiveness. The advantages of the internal models approach will be realized only if (a) the bank's internal risk measurement model is capable of providing an accurate measure of a bank's risk exposure over a holding period of concern to the regulators, and (b) that the regulatory authority can verify that each bank's model is indeed providing such an accurate measure of the bank's risk exposure. In practice, it might well turn out that neither of these two conditions are completely satisfied.

Importantly, these models are not designed to measure the longer-horizon exposure that is the intended basis of regulatory capital requirements. Simply stated, longer horizon risk exposure depends not simply on a bank's initial risk exposure, but also on its risk management strategy and the risk control systems that a bank has in place. Risks need to be measured and managed on a daily basis. However, the longer the horizon, the less important will be the initial risk exposure and the more important will be management's risk objectives and the bank's risk management system. The internal models proposal sets the capital requirement at some multiple of the model risk-risk estimate for an initial portfolio composition. This risk measure places undue emphasis on the initial portfolio at the expense of ignoring the importance of the bank's risk management objectives and the efficacy of its risk control systems.

The pre-commitment approach

An alternative to model-based regulation, another approach which has gained currency in recent times has been the Pre-commitment Approach (PA). Unlike the VaR, which retains the basic CAR philosophy of a 'hard link' between risk exposure and capital requirements, the PA emphasizes the use of a 'soft link', i.e., a link arising endogenously rather than being externally imposed.

Under this approach, each bank pre-commits an amount of capital to cover what is believed to be its maximum trading loss exposure over a given regulatory horizon, which can be one quarter or even a shorter period. The capital becomes the focus of regulation. A bank would be in breach of this pre-commitment if cumulative losses from the

beginning of the capital period exceeded its capital commitment on any close of business. The appeal of the PA lies in the fact that it does not require the regulator to estimate the level of trading book risk of any specific bank. Nor does it require the regulator to try to ensure that the internal model used to calculate risk is accurate. This is because back-testing to check the accuracy of an internal VaR model is difficult in the sense that a large number of observations are required before an accurate judgement can be made about the model. Banks which have good risk management systems, conservative portfolios, or more risk averse preferences, could pre-commit to lower maximum loss levels and hold less capital because of their confidence that they will not breach their pre-committed maximum trading loss. The task of the regulator is to choose an appropriate schedule of penalties to induce a desirable choice of cover for each level of risk and capital choices for the trading book. Since it does not require the regulator to estimate the level of trading book risk of any particular bank or to approve the firm's model, it promotes a more 'hands-off' regulation.

In this situation, breaches have been sought to be penalised in two ways. First, there would be explicit regulatory penalties. Second, the commitment could be publicly disclosed, providing a double incentive for the bank to contain losses within its committed capital and to not greatly over-commit capital. The latter may send signal of an effective risk measurement system, as well as of possible excessive risk exposure in the upcoming period. It also encourages the regulatory authorities to act promptly over breaches, imposing the necessary penalties and determining management shortcomings. Disclosure therefore both complements and strengthens the incentives created by the penalties.

IV. Pros and cons of market risk models

Regulators traditionally have utilized simple, generic models to measure bank capital adequacy. This is no longer possible: the increased presence of market risk in banks, and the opaqueness of such risk in a portfolio have rendered such an approach less than satisfactory. Three main alternative approaches have emerged in the literature to replace it. Out of them, VaR and PA have the potential for greater applicability in the Indian scenario. Each approach needs to be judged on the basis of the trade-off between the

prevention of the costs of bank failure and the costs of implementation of such regulations.

The VaR concept can potentially be applied to both credit and market risk, thus allowing for the possibility that, in time, banks may be able to have a single firm-wide measure of these risks across all business areas, and so measure return on (credit and market) risk consistently across the whole firm. The concept, however, has no substitute for the wider risk management process of analyzing stress scenarios and keeping tabs on operational and legal risks. For example, neither the VaR nor the other approach offers a direct solution to the problem of operating risk-the existence of sloppy internal controls-which has been responsible for many of the recent problems involving derivatives (Stephanou, 1996)¹².

The internal model approach based on VaR is an improvement to the BBA, since it is aligned to bank industry best practice. However, the attempt by regulators to create consistent estimates of VaR across different institutions' models, as well as their conservative parameters, have reduced the approach's appeal. In addition, at least in the near future, its application will be limited to a relatively small number of institutions that have both material trading activities and sophisticated, comprehensive VaR models (Crouhy *et al.*, 1997).

In contrast to the aforesaid model which supports model-based regulation, the pre-commitment approach bypasses the micro-management of banks models, focusing instead on outputs. If appropriate incentive-compatible penalties can be devised, the incentives for gaming by banks, present in different ways and extent in both the BBA and the IMA are significantly reduced. It is necessary though for the PA to be further examined and refined, given the severe doubts that still exist over the implications of its adoption in practice¹³ For instance, the PA proposal has been criticized on grounds that

¹² As per existing information, regulatory agencies are thinking in terms of n-day VaR models, 'n' often being 15. This should ameliorate the problem to an extent.

¹³ A Pilot Project of the Pre-commitment Approach was organised by the New York Clearing House Association and ten participating institutions (Considine, 1998). The exercise demonstrated that (a) the PA is a viable alternative to the internal models approach for establishing the capital adequacy of a trading business for regulatory purposes, (b) while there were differences in each institution's perception of determining an appropriate amount of capital (free of any regulatory pre-conceptions), the institutions believed that such differences arose from differences among the institutions in the nature of their trading books, the varying risk appetites and risk management

ex-post penalties are particularly limited in situations of undercapitalisation (Daripa *et al.*, 1997)¹⁴.

V. Concluding observations

The views of the regulators and the industry on the appropriate method of setting bank capital standards for market risks have evolved away from the use of regulatory standard model approaches and towards the use of banks' internal risk estimates. This evolution represents a promising development as internal-model based approaches have clear advantages, both in terms of the efficacy as well as effectiveness of risk-based capital standards. While the internal models approach focuses solely on risk measurement of a static portfolio and ignores the fundamentally important determinants of bank's trading risk-its-risk-taking strategy and its risk management ability, the pre-commitment approach, on the other hand, is yet to gain international recognition.

Banking, in the ultimate analysis, is an exercise in risk management and to the extent that risks are adequately addressed, the task of pro-active management of banking operations can be greatly enhanced. With the gradual convergence of domestic markets in India with global ones, the issue of risk and its management will remain to the forefront for several years to come. Prominent among these would be market risks. Banks would need to critically evaluate their existing risk management system and identify the shortcomings so as to devise apposite strategies for actively dealing with the same.

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techniques, differing ratios of proprietary trading revenues to customer flow revenues among firms and different views as to the relationship between economic and regulatory capital.

¹⁴ Rochet (1999) has provided a theoretical perspective on the relationship between the IMA and PA. As Rochet observes, the PA is an "indirect mechanism" while the IMA is a "direct mechanism" in the terminology of mechanism design. The two ought to be equivalent if the risk structure changes quickly over time and the regulators lack the expertise to see through internal models.

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Appendix A : Value-at-risk and Pre-commitment Approach to measurement of market risk

I. Value at Risk Approach

The bank's capital charge at date t is based on the larger of the bank's current 10-day-ahead risk estimate or the average of its risk estimates over the prior 60 business days, subject to a multiplication factor. Let VAR_{t-1} represent a bank's risk exposure estimate for date $(t-1)$, and CMR_t represent the bank's market risk capital requirement for date t . The bank's regulatory market risk capital requirement is,

$$CMR_t = \text{Max} \left[\frac{SM_t}{60} \sum_{i=1}^{60} VaR_{t-i}, VaR_{t-1} \right] + SR_{t-1}, \quad (A1)$$

where SM_t is the supervisory determined multiplication factor and SR_t is the additional capital charge for the specific risk of trading book positions. The proposed minimum value for the multiplication factor, SM_t is 3. The multiplier can be increased if the supervisor is not satisfied with the accuracy of a bank's risk exposure estimate. For verifying risk estimates, a "back-testing" methodology is proposed which would be based on the frequency of realized daily losses exceeding the models' predicted daily losses at the 1 per cent critical values. The specific risk capital charge applies to traded debt and equity positions. It is intended to account for idiosyncratic risks, as risk measurement generally measure risks generated by market-wide factors. The specific risk charge is equal to one-half of the specific risk capital charge as calculated under the standardised approach.

II. Pre-Commitment Approach to Market Risk

Assume that the bank's overall financial position is such that the bank could pay any penalty that it might incur for a capital violation. The penalty is assumed to be a direct Rupee charge proportional to the excess of the loss over the pre-committed capital. Let K_T denote the capital committed to cover trading losses. The *ex-post* charge for a capital commitment breach is

$$\Psi(\Delta V) = -\psi \text{Min} \{ \Delta V + K_T, 0 \} \quad (A2)$$

where ΔV represents the change in the value of the trading portfolio realized at the end of the period. Thus, the bank incurs a penalty if

$$\Delta V < -K_T \quad (A3)$$

In determining the appropriate incentives, the cost of regulatory capital to the bank plays an important role in determining the appropriate regulatory choice of a penalty rate, ψ . Among other things, this cost will depend on the bank's leverage and will vary with the leverage ratio. For purposes of this illustration, the bank's cost of regulatory capital is assumed to be strictly proportional at the rate R to the level of capital. Let $f(\Delta V)$ be the

probability density for ΔV , $F(\Delta V)$ be the associated distribution function and r the required discount rate on a payoff described by $\Psi(\Delta V)$. The full cost of the capital commitment, inclusive of potential penalty, is

$$R K_T - \frac{\psi}{1+r} \int_{-\infty}^{-K_T} (\Delta V + K_T) d(\Delta V) \quad (\text{A4})$$

The first term of expression (A4) is the current cost of committing K_T of capital to trading risk. The second term is the current value of the monetary policy for a pre-commitment violation.

Assuming that the bank minimizes (A4), the capital commitment K_T that satisfies an interior optimum first-order condition is given by the expression:

$$R = \frac{\psi}{1+r} F(-K_T^*) \quad (\text{A5})$$

Expression (A5) suggests how the regulator might set an appropriate penalty rate. Solving (A5) for Ψ leads to the penalty rate

$$\psi^* = \frac{R(1+r)}{F^*} \quad (\text{A6})$$

where F^* represents the regulator's objective in terms of the probability of trading losses exceeding committed capital. Replacing Ψ in expression (A5) with the optimal penalty rate in expression (A6) shows that a cost-minimising bank will choose a capital commitment K_T^* , such that,

$$F(K_T^*) = F^* \quad (\text{A7})$$

Expression (A6) indicates that the penalty rate is inversely related to the regulator's acceptable probability of losses exceeding capital. Lowering the desired probability of observing a breach of capital lowers the likelihood of a penalty and thereby, lowers the expected penalty cost. To counter this effect, a higher penalty rate is needed. Expression (A6) also indicates that the appropriate penalty rate depends on the cost to the bank of meeting the regulatory capital commitment, R (with r being of second order importance). In general, it is difficult to know this cost as it will depend on the value of the leverage to the bank. A single penalty rate that reflects the highest cost of regulatory capital will be a conservative approach in that it will lead to over-commitment by most banks. Thus, some flexibility in the penalty rate based on the likely cost of regulatory capital would be desirable.¹⁵

¹⁵ In case where R is zero, the bank would want to commit equity even if $F(-K_T) < F^*$.